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Development of Far-Infrared Microspectroscopy at Beamline U2B

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Beamline(s): U2B

ABSTRACT: To date, infrared microspectroscopy has been limited to the mid-infrared region. Commercial infrared microscopes are equipped with mercury-cadmium-telluride (MCT) detectors and KBr beamsplitters, which limit the infrared frequency range to 4000-650 cm^{-1}. In addition, conventional globar sources have a limited output in the far-infrared region (50-650 cm^{-1}). Using a synchrotron infrared source, silicon beamsplitter, and bolometer detector, we have developed the first infrared microscope capable of collecting data in the far-infrared region. A commercial Nicolet NicPlan infrared microscope, coupled to a Nicolet Magna 860 FTIR, is used. Instead of using the internal, globar source, we have modified the spectrometer to accept infrared light from Beamline U2B at the National Synchrotron Light Source. Synchrotron infrared light is 100-1000 times brighter than the globar in the far-infrared regime. Instead of using the standard MCT detector supplied with the NicPlan microscope, we have added a pick-off mirror to redirect the infrared beam into an external, bolometer detector. The entire beam path is purged with nitrogen to minimize water vapor absorption in the far-infrared region. With these modifications, we demonstrate for the first time the ability to collect far infrared spectra on minute samples using an infrared microscope.

Among the results thus far, we have identified a broad collagen band in the far infrared spectrum (350 cm^{-1}) of bone tissue that has not be observed before and may provide useful for analysis of collagen structure and composition in normal and diseased states of bone.